L Number	Hits	Search Text	DB	Time stamp
1	562	514/282, 514.ccls	USPAT	2001/11/15 10:43
2	238	546/44.ccls.	USPAT	2001/11/15 10:44
4	812	514/307.ccls.	USPAT	2001/11/15 10:44
6	1492	546/44.ccls. or 514/282.ccls. or 514/307.ccls. or 436/93.ccls.	USPAT	2001/11/15 10:45
5	116	436/93.ccls.	USPAT	2001/11/15 10:45
3	376	514/282.ccls.	USPAT	2001/11/15 10:48

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More Accessions in the Papaveraceae :

- Chelidonium majus

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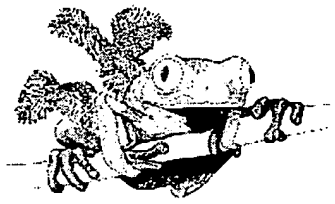


Chelidonium majus *L.*

■ **General information:**

- Query NCU-3e
- **Common Name:** Greater Celandine, Swallow-wort
- **Family:** Papaveraceae *Juss.*

- **Country of Origin:** temp & subarctic Eurasia
- **Habitat:** Rubble, damp ground, banks, hedgerows and by walls

- **Description:** One species, differing from Papaver in stalked stigmas, arillate seeds. Produces an orange latex long-used in eye disorders, classically mixed with fennel, wormwood, honey & a dash of human milk, certainly efficaceous in treatment of warts & other skin disorders.

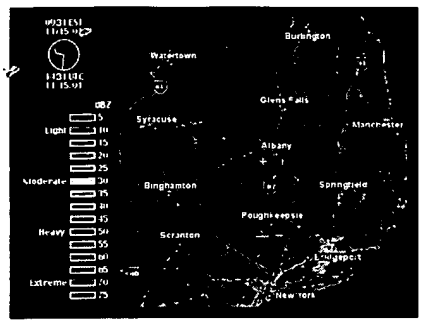
- **Culture:** Prone to two spotted spider mites

■ **Accession Data:**

- **Accession #:** 199200239
- **Source:** Unknown
- **Accession Date:** / /
- **Bench:** 3311 - West Bench
- **Qty:** 1 confirmed on 01/18/01

■ **Classification:**

- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **SubClass:** Magnoliidae
- **Order:** Papaverales
- **SubOrder:**
- **Family:** Papaveraceae
- **SubFamily:**
- **Tribe:**
- **SubTribe:**



Cloudcover Animation
Radar Animation
US Severe Weather

Contact:

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Clinton Morse
Plant Growth Facility Manager

University of Connecticut

Last Updated: October 11, 2001

Based upon: Watson, L., and Dallwitz, M. J. (1992 onwards). 'The Families of Flowering Plants: Descriptions, Illustrations, Identification, and Information Retrieval.' Version: 19th August 1999. http://biodiversity.uno.edu/delta/.

■ Search Internet:

- Search Google for this taxon
- Search Metacrawler for this taxon

■ Class Usage in the past 36 months:

- None Recorded

■ Material to other institutions in the past 60 months:

- None Recorded

■ Pesticide applications in the past 12 months:

- Monday, October 30, 2000 - Spray with Knox-Out GH - Agro-Tec Wet Spray
- Thursday, October 26, 2000 - Spot Spray w/ M-Pede

■ Miscellaneous Notations:

- None Recorded

■ Credits:

- Plants For A Future Website

■ Disclaimer:

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More importantly, many of the plants in our collections have reputed medicinal properties according to some sources. We will only reproduce information we believe to be correct, but we make no claims as to the validity of this information.

In particular, many plants with medicinal properties are also toxic and frequently FATAL if taken at incorrect dosages or if not prepared in a specific fashion. We do not advocate the consumption of reputed medicinal plant products without prior consultation with your physician or other natural plant products professional.

The staff of the EEB Conservatory are not trained medical personnel and information from this website or from personnel affiliated with our facility should be treated as anecdotal information only and not as specific recomendations for usage. We make no claims about the efficacy of any plant or plant part for any specific remedies which may be alluded to on this website.

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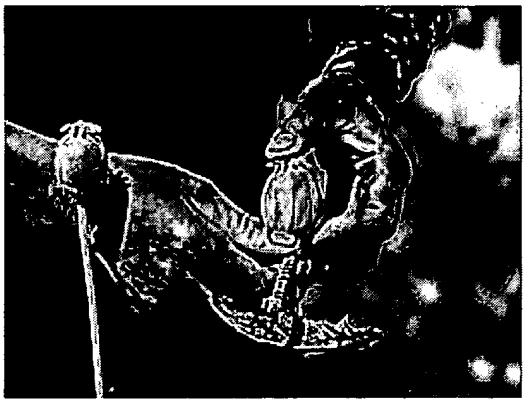


heroin manufacture

The following is not intended as a recipe for making heroin, nor should it be of much use as such. This is simply a description of the large-scale, illicit manufacture of heroin. Most of the information on synthesis comes from the DEA publication **Opium and Heroin Cultivation in Southest Asia**. At one time, an adapted version of this text was on the web, but it has since been taken down. The text from that site may now be found in this file with additional commentary by Jim Hogshire and at Rhodium's chemistry archive. (The sections on history and pharmacology are not in the original.)

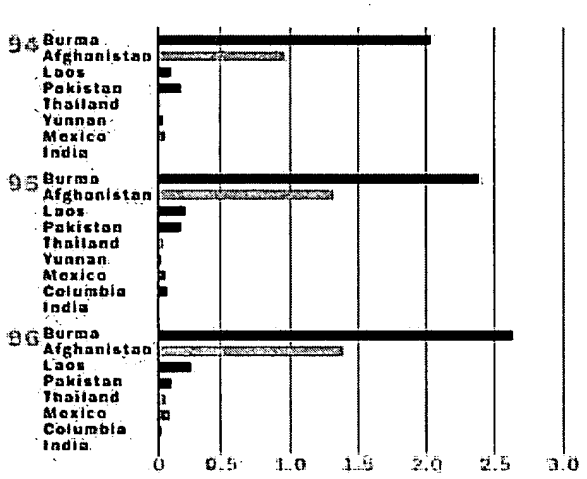
consider yourself the 10634th

I. The World Harvest

Illicit cultivation of the opium poppy, *Papaver somniferum,* has traditionally been an Asian enterprise. More recently, production has spread to the highlands of the tropical regions of the Western Hemisphere, primarily Mexico and Colombia. The worldwide illicit opium harvest in 1995 was estimated at 4,157 metric tons, the majority accounted for by the estimated 2,561 tons produced in Southeast Asia (primarily Myanmar (Burma), with a substantial harvest in Laos and smaller crops

in Thailand, China, Vietnam, and Cambodia) (1). More recently Afghanistan has been the number one illicit producer of opium, with an estimated harvest of over 4,500 metric tons in 1999 with the South East Asian harvest declining to about half its mid-90s peak (11, 12). Colombia has held steady in the range of 60-70 tons per year (2), while Mexico's harvest has hovered in the 50 ton range since the mid-1990s. (3). Heroin originating from these Western Hemisphere sources is destined almost exclusively for the United States, while Southeast Asian product enjoys worldwide distribution. Heroin of Southwest Asian origin is mostly exported to Europe or consumed regionally, where there is a steadily rising addict (and overall) population (esp., Pakistan and India(12)).

Opium production in selected source countries 1994-96(metric tons)



Source: PBS Frontline, 1997

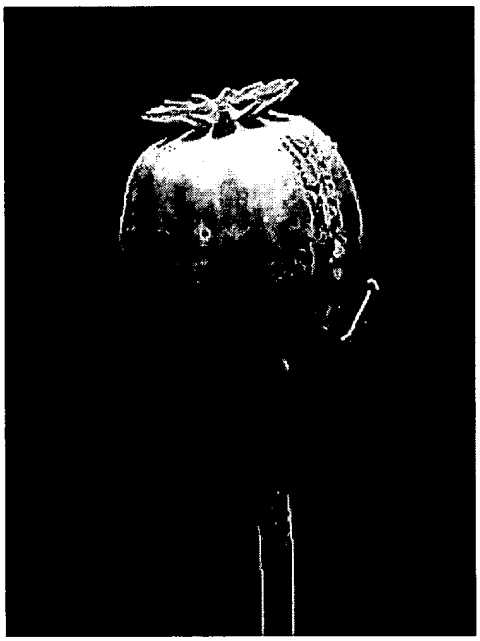
P. somniferum is an annual, flowering plant, believed to have evolved, through centuries of breeding and cultivation, from a wild-growing ancestor native to the northeastern Mediterranean coast (4). It grows best in dry, temperate climates, usually at altitudes of over 800 meters (2500 ft) above sea-level. The optimal growing season is from September to July depending on the regional climate. In Southeast Asia, planting is completed by late October, in order to take advantage of the long days of the Southern Hemisphere winter. Growing plots are selected for maximum sun exposure on slopes of gradients of 20 to 40 degrees for optimal drainage. (Excessive moisture is damaging to the plant). About one pound of seed is needed to sow one acre of land. By November, when the young plant enters the "cabbage" or "lettuce" stage and has reached a height of about one foot, some of the plants are removed in order to leave room for the others to grow (about 1 to 2 feet

between plants). A typical opium poppy field has 60,000 to 120,000 plants per hectare (2.46 acres) (5). The mature plant reaches a height of about 2-5 feet by late winter, beginning to flower after about 90 days of growth, 3 to 8 flowers per plant. Flowering continues for several weeks, reaching full bloom by early spring (or later, depending on the region; later development is typical in more western regions (4)). After full bloom, the petals drop to reveal a small, round grayish-green fruit which continues to develop into an oblate, elongated or globular capsule (also called the seedpod, bulb or poppy head) about the size of a chicken egg. The skin of the pod encloses the ovary, the walls of which secrete the latex (opium) which collects in a network of vessels and tubes throughout the pod.

The cabbage stage

About two weeks after the petals have fallen, the pods are fully mature, as indicated by the aforementioned shape of the capsule, a change in color from grayish-green to dark green; the points of the pods crown now stand straight About two weeks after the petals have fallen, the pods are fully mature, as indicated by the aforementioned shape of the capsule, a change in color from grayish-green to dark green; the points of the pods crown now stand straight out or are curved upward. At this point the pods are ready to be scored (or tapped, incised or lanced). Harvesters make the incision with a a three- or four- bladed instrument (iron or glass blades bound tightly on a wooden handle), designed to make an incision of about one millimeter deep. (Too deep an incision may result in excessive spilling either into the center of the pod or to the ground; too shallow and the latex will not ooze as desired). The pods are scored two to three times each in the afternoon, causing the white latex to drip onto the surface of the pod. The opium oxidizes,

darkens, and thickens overnight, and in the morning is scraped from the surface with a flat iron blade. This process is repeated over several days until each pod is depleted of its opium. Each pod may yield from 10 to 100 milligrams of opium, with an average of 80 milligrams, which is set aside in a container to dry in the sun. (Pods giving highest yields are marked, cut from the plant, cut open and dried in the sun, their seeds saved for the next planting). Dried, raw opium is brown to black in color; higher-quality product is brown and sticky. A typical farm will produce 3 to 9 kilograms of opium per acre (5).



Latex dripping from mature poppy pod.

II. Opium: Some vital statistics.

Over 40 different alkaloids have been identified as present in opium (4,6), mostly as salts of meconic acid (4). The most important of these, of course, is morphine. Although Turkish opium ("Druggists Opium") may contain up to 21% morphine (4), the average morphine content of opium tapped from *P. somniferum* is 9 to 14% by mass. Next most prominent is codeine (3-methylmorphine) which constitutes 0.5 to 2.5% of the dried latex. Noscapine, comprising 4 to 8% of opium, has been used as an over-the-counter, non-psychoactive cough suppressant (6). Papaverine, present at 0.5 to 2.5%, is administered as a muscle-relaxant. Thebaine, 0.5 to 2%, is a convulsant in high doses; it is also similar in structure to morphine and is used in the licit manufacture of semisynthetic opiates such as hydrocodone and oxycodone. (Other species of poppy, notably *Papaver bracteatum,* contain higher concentrations of thebaine and are cultivated for the extraction of this alkaloid(7)). Other alkaloids include narceine, protopine, laudanine (laudanosine),

codamine, cryptopine, lanthopine, and others.

Ideally, the above alkaloids should be removed in the purification of opium for conversion to heroin. However, clandestine chemistry is rarely ideal, and some of these alkaloids are often not removed, remaining as imupurities of origin. The most notable impurity of origin results from the failure to remove codeine. The manufacture of heroin, discussed in detail below, involves the acetylation of morphine to form 3,6-diacetylmorphine. Acetylated codeine (acetylcodeine) often constitutes 10% of the narcotic content of street heroin, sometimes up to 45% of this quantity (6). Acetylcodeine is a key marker used in signature analysis of heroin, as the heroin-to-acetylmorphine ratio of seized batches has been found to vary among source countries (6,8-10). Also, acetylcodeine has been found to be two times as toxic as diacetylmorphine (heroin) in mice (6), and hence it may contribute to street heroins toxicity. Unreacted morphine and codeine are also present in some poorly processed heroin, which may bring about adverse reactions in users, especially when the drug is injec, and hence it may contribute to street heroins toxicity. Unreacted morphine and codeine are also present in some poorly processed heroin, which may bring about adverse reactions in users, especially when the drug is injected intravenously. The non-phenanthrene alkaloids (i.e, all alkaloids except morphine, codeine, and thebaine) are more rarely found, probably decomposed in the acetylation process (6). Noscapine, papaverine, laudanosine and/or cryptopine are occasionally present but in such small amounts that although toxic at higher doses, they are not thought to contribute to the pharmacological effects of street heroin. Thebaine is decomposed by acetylation, and although the decomposed product, acetylthebaol, is sometimes present, it is not thought to have any harmful effect.

III. Heroin manufacture

The complete conversion of raw opium to pure heroin hydrochloride (diacetylmorphine HCl) may be summarized as follows:

(1) Purification of raw opium -->
(2) extraction/purification of morphine from opium -->
(3) conversion of morphine to heroin base -->
(4) purification of heroin base and conversion to hydrochloride salt

After step 4, diluents and adulterants may be added either by the manufacturer or by parties further along the distribution chain. Also, shortcuts may be taken at steps 2, 3 and 4, and steps 2 and 4 may be eliminated altogether. The process delineated in this section is that observed in Southeast Asia (5), designed to result in nearly pure diacetylmorphine HCl.

1. Purification of opium.

Raw opium is placed in an open cooking pot of boiling water. This should dissolve all of the alkaloids in the opium, while solid plant material, soil, twigs, etc. remain undissolved and float to the top of the solution. Solid impurities are scooped out or filtered by straining the mixture though cheesecloth or burlap. The liquid is then re-heated over a low flame, evaporating the water to leave behind a thick, dark paste, which is then dried in the sun. The opium left behind has a putty-like consistency and is generally about 20% lighter (20% more pure) than the raw material. At this point the product may be exported for smoking or eating or consumed locally. This process may be carried out by farmers before shipping for consumption or further processing, or the raw opium may be transported to heroin manufacturing sites where the preparation is undertaken on a larger scale.

2. Extraction of morphine.

Processed opium is stirred in large drum of boiling water until it has completely dissolved. Slaked lime (calium hydroxide), at about one-fifth the mass of opium (8), (or a fertilzer with a high lime content) is added to the solution. This has the effect of converting morphine, insoluble in cool water, into the soluble salt, calcium morphenate. For the most part, the other alkaloids do not react, and when the mixture is cooled, the morphenate remains in solution, while the other chemicals settle to form a brown sludge at the bottom of the container. (Codeine is somewhat soluble in water and some amount is

likely to remain in solution). The calcium morphenate solution is scooped or poured from the drum and filtered and pressed through burlap rice sacks or some other makeshift filtration apparatus. The filtered solution is re-heated, but not boiled, in cooking pots to which ammonium chloride is added at about one-fourth the mass of opium processed (8). After the pH of the solution reaches 8 or 9 it is cooled. Within a few hours, morphine base and any remaining codeine precipitate out of solution and settle to the bottom of the pot. The solution is then poured off through cloth filters, leaving chunks of morphine base on the cloth, which are squeezed dry and set aside to dry further in the sun. The dried crude morphine base is a coffee-colored powder. (A more scrupulous chemist might use ether in the filtration to dis. After the pH of the solution reaches 8 or 9 it is cooled. Within a few hours, morphine base and any remaining codeine precipitate out of solution and settle to the bottom of the pot. The solution is then poured off through cloth filters, leaving chunks of morphine base on the cloth, which are squeezed dry and set aside to dry further in the sun. The dried crude morphine base is a coffee-colored powder. (A more scrupulous chemist might use ether in the filtration to dissolve any residual codeine out of the base mixture, but this is not reported in accounts of illicit manufacture).

From this point, some manufacturers may proceed directly to step 3. Ideally, however, the crude morphine base is purified by dissolution in dilute hydrochloric (or sufuric) acid, forming a solution of morphine hydrochloride (or sulfate). Activated charcoal is added, and the solution is heated and filtered hot through a fine cloth. The filtration process is repeated several times, removing the charcoal and colored impurities with it. The The filtrate may be dried in the sun to leave behind morphine hydrochloride, a fine white powder if purification is complete, which may be pressed into 1 kg bricks and transferred for further processing at a remote site. Alternatively, ammonium hydroxide may be added to the morphine HCl solution (or re-dissolved morphine HCl), precipitating morphine base, filtered and dried to form a granular solid (8).

3. Conversion of morphine to heroin base.

The key chemical used in the acetylation of morphine to form

heroin is acetic anhydride, a colorless, highly combustible liquid with a strong pickle-like odor. Though internationally controlled as a heroin precursor, acetic anhydride also used to synthesize aspirin and chemicals for leather tanning and photography. Morphine hydrochloride or morphine base is mixed with acetic anhydride at about three-times the mass of the former in a stainless steel or enamel pot. The pot lid is tied or clamped on with a damp towel for a gasket, and the mixture is heated at 85 degrees Celsius (185 degrees F), avoiding boiling. The cooking proceeds for about 5 hours until all the morphine has dissolved. The pot is opened, and the mixture -- now a solution of water, acetic acid, and diacetylmorphine (heroin) -- is allowed to cool. Water is added to the mixture at three-times the volume of acetic anhydride, and the mixture is stirred. (Optionally, a small amount of chloroform is added. The mixture is allowed to stand for 20 minutes. The chloroform dissolves colored impurities and settles to the bottom of the pot as a red, greasy liquid, and the water layer is carefully poured off.) Activated charcoal is added to the mixture, absorbing solid impurities, which are filtered out repeatedly until the solution is clear. Approximately 2.2 kilograms of sodium carbonate (soda ash) per kilogram of morphine are dissolved in hot water and added solwly to the mixture until effervescence stops, precipitating solid heroin base. Heroin base is filtered with a fine cloth, set aside and heated until dry. The heroin base should be a granular, white powder at this point. If still colored (beige or light brown), the base may be re-dissolved in dilute hydrochloric or citric acid (8), treated with charcoal again, re-precipitated and dried. Alternatively, in some manufacturing regions, the incompletely purified base may be packed and transported for sale (a practice probably typical in Southwest Asia). About 700 grams of heroin base will be produced from each kilogram of morphine.

Skilled heroin chemists further purify the base by dissolving it in twice its mass of boiling ethyl alcohol and filtering the solution through a heated funnel into a heated flask. This removes traces of sodium carbonate remaining in the base. The flask is submerged in an ice bath, where it is transformed into a thick white cream. The substance is placed in a pan in a refrigerator with a fan set to blow across the pan to slowly evaporate the alcohol. The paste crystall Skilled heroin chemists further purify the base by dissolving it in twice its

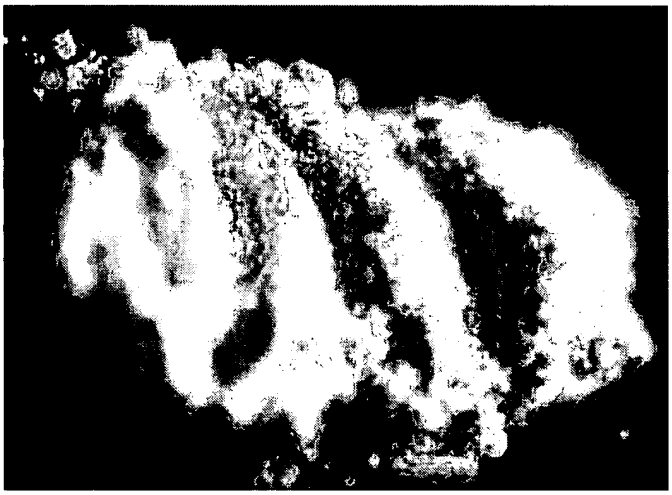
mass of boiling ethyl alcohol and filtering the solution through a heated funnel into a heated flask. This removes traces of sodium carbonate remaining in the base. The flask is submerged in an ice bath, where it is transformed into a thick white cream. The substance is placed in a pan in a refrigerator with a fan set to blow across the pan to slowly evaporate the alcohol. The paste crystallizes after several hours and is then vacuum filtered. The product, sometimes referred to as "alcohol morphine base," is simply re-crystallized heroin base.

4. Conversion of heroin base to heroin hydrochloride.

For each kilogram of heroin base (or re-crystallized heroin base), 6.6 liters of of ethyl alcohol, 6.6 liters of ether, and 225 milliliters of concentrated hydrochloric acid are measured out. The base is dissolved by heating with one-third of the alcohol and one half of the acid. Another one-third of the acid is stirred in. Next, the remaining acid is added slowly, dropwise, until the product is completely converted to the hydrochloride salt. This result may be confirmed either by observing that a drop of solution evaporates on a glass plate leaving no cloudy residue or by placing a drop of solution on Congo red paper, observing it turn the paper blue. Once the conversion is complete, the remaining alcohol is stirred in. Then half of the ether is added, and the mixture is allowed to stand for 15 minutes. As soon as crystals begin to form in the solution, the remaining ether is added at once, stirred, and the the vessel is covered. The mixture becomes nearly solid after an hour. It is then filtered, and the solids are collected on clean filter paper. Wrapped in the paper, the solid is dried on a wooden tray, usually over lime rock, and dried in the sun. The fully dried product, heroin hydrochloride, is a fine white powder, ready for packing and shipping.

IV. Varieties of product and adulterants

Mexican "tar" heroin



Southeast Asian heroin hydrochloride

[More Coming Soon...maybe...]

References:

1. *The Supply of Illicit Drugs to the United States,* National Narcotics Intelligence Consumers Committee, 1995, Drug Enforcement Administration.

2. *Report of the International Narcotics Control Board for 1996.* International Narcotics Control Board, United Nations Publication, 1996.

3. Constantine, Thomas A. The Threat of Heroin to the United States. Statement Before the House Subcommittee on National

Security, International Affairs and Criminal Justice Committee on Government Reform and Oversight, September 19, 1996.

4. Claus, E.P., Tyler, E.T., Brady, L.R. *Pharmacognosy (6th ed.),* 1970. (Lea & Febiger: Philadelphia).

5. *Opium Poppy and Heroin Cultivation in Southeast Asia.* Drug Enforcement Administration, Intelligence Division, Sept, 1993. (DEA - 92004)

6. Soine, W.H. Clandestine drug synthesis. *Medicinal Research Reviews.* 6:1 (1986), pp. 41-74.

7. Sharghi, N. & Lalezari, I. *Papaver bracteatum* Lindl., a highly rich source of thebaine. *Nature,* (March 25, 1967), p. 1244

8. Narayanaswami, K. Parameters for determining the origin of illicit heroin samples. *Bulletin on Narcotics,* 37:1 (1985), pp. 49-62

9. O'Neil, P.J., Baker, P.B. & Gough, T.A. Illicitly imported heroin products: Some physical and chemical features indicative of their origin. *Journal of Forensic Sciences,* 29 29:3 (1984), pp. 889-902.

10. O'Neil, P.J. & Pitts, J.E. Illicitly imported heroin products (1984-1989): Some physical and chemical features indicative of their origin. *Journal of Pharmacy and Pharmacology,* 44 (1992), pp. 1-6

11. Weber, O. Drogue: comment les taliban inondent le monde. *Le Point,* 1446 (June 2000), pp.81-90

12. *Report of the International Narcotics Control Board for 2000.* International Narcotics Control Board, United Nations Publication, 2001.